

EFFECTS OF DEFENSIVE VEHICLE HANDLING TRAINING ON NOVICE DRIVER SAFETY: PHASE 1. PREPARATION FOR ADVANCED DRIVING TRAINING

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THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

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FEDERAL HIGHWAY ADMINISTRATION

December 2005

prepared by
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RESEARCH PROGRAMS



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Effects of Defensive Vehicle Handling Training on Novice Driver Safety:
Phase 1. Preparation for Advanced Driving Training

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A report prepared for the

MONTANA DEPARTMENT OF TRANSPORTATION
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| 16. Abstract New teenaged drivers have the highest accident rates of any group of drivers. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation. The purpose of this research program was to conduct such a study. This report summarizes Phase 1 of the three-phase project. Phase 1 included (A) identification of potential participants, (B) development of recruiting materials, (C) recruitment and scheduling of participants, (D) preparation of training plans and instructional materials, and (E) coordination with the Montana Office of Public Instruction for use of their facilities and instructors for the training workshops. During Phase 2, approximately half of the recruited subjects will receive an intervention that involves a one-day classroom and behind-the-wheel workshop. The training will take place 6 - 12 months after they complete high school driver education. During Phase 3, teens will be tracked for 4 years following the project to determine the driving history comparisons of the control group to those who received the intervention. Reported accidents, violations, and driving experience will be compared once per year during this monitoring period. | | | | | |
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The Defensive Driving training curriculum was developed by Mr. Fred Mottola of the National Institute for Driver Behavior whose years of experience in training young drivers provided a solid foundation for the training workshops.

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2. EXECUTIVE SUMMARY

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation. Many novice drivers' accidents involve improper reactions to skids, panic stops, run-off-pavement, and other unusual situations unfamiliar to the young driver.

A large percentage of young drivers receive their driving training in school-based classes. These classes typically involve numerous hours of classroom instruction on rules of the road, vehicle operation, and safety. The nascent drivers then spend several hours behind the steering wheel driving in parking lots or in normal traffic on familiar streets. Only rarely do they experience circumstances in which the vehicle must be handled at its performance limits. Most carefully controlled research has found that standard driver education classes have little impact on subsequent driving safety.

Several organizations in the United States offer training in advanced vehicle handling for novice drivers. Such training typically includes vehicle control on skid pads, obstacle avoidance, rapid deceleration braking, and maneuvering near the vehicle performance limits. While there is considerable anecdotal evidence that such training, added to the standard driver instruction, creates a more capable novice driver, few systematic studies of its effect on the safety of young drivers has been completed. A study of over 400 graduates of an urban, east coast course, reported that the graduates had 77% fewer accidents than their peers. That number, however, was probably inflated by a weak research design in which the more careful and highly motivated teens were self-selected into the training classes. A second study, conducted in Oregon, found no overall safety benefit from a course designed to teach high performance maneuvering and skid avoidance/recovery. A much more carefully designed and controlled study was needed to explore and validate those divergent results.

The purpose of this research program was to conduct such a study. This report summarizes Phase 1 of the three-phase project. Phase 1 included (A) identification of potential participants, (B) development of recruiting materials, (C) recruitment and scheduling of participants, (D) preparation of training plans and instructional materials, and (E) coordination with the Montana Office of Public Instruction for use of their facilities and instructors for the training workshops.

During Phase 2, approximately half of the subjects recruited in Phase 1 will receive an intervention that involves a one-day classroom and behind-the-wheel workshop. The training will take place during summer 2005, 6 - 12 months after they complete high school driver education. The workshop will include a pre-assessment of skills based upon Mottola's 10 driving habits, training on the habits and a post-assessment at the end of the day. Most of the day will be involved in training students in the key habits that address the greatest number of driving crashes teens in Montana experience. Communications will be provided to parents and teens at time of recruitment, just prior to workshop, and a tailored communication at the end of the training that outlines the key issues each individual student needs to continue to work on with suggestions to parents on how to help the student. For an additional three months, the student will be encouraged to complete follow-on exercises based on their tailored feedback from the workshop.

During Phase 3, teens will be tracked for 4 years following the project to determine the driving history comparisons of the control group to those who received the intervention. Reported accidents, violations, and driving experience will be compared once per year during this monitoring period.

This report covers Phase 1 of the project.

3. INTRODUCTION

3.1. The Safety Statistics

Each year, roadway accidents take the lives of approximately 40,000 people and seriously injure approximately 3 million in the United States (U. S. Department of Transportation, 2005). The costs of these accidents approach \$200 billion.

Young teenaged drivers have a considerably higher accident rate than any other age group. New teenaged drivers have the highest accident rates of any group of drivers. Figure 1 shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population (Williams, 2003). The youngest (15 and 16 year-old) drivers have a higher crash rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience and increased maturity. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation. Many novice drivers' accidents involve improper reactions to skids, panic stops, run-off-pavement, and other unusual situations unfamiliar to the young driver. Other accidents can partially be attributed to lifestyle issues such as risk-taking, risk-seeking, peer pressure and approval, and substance abuse.

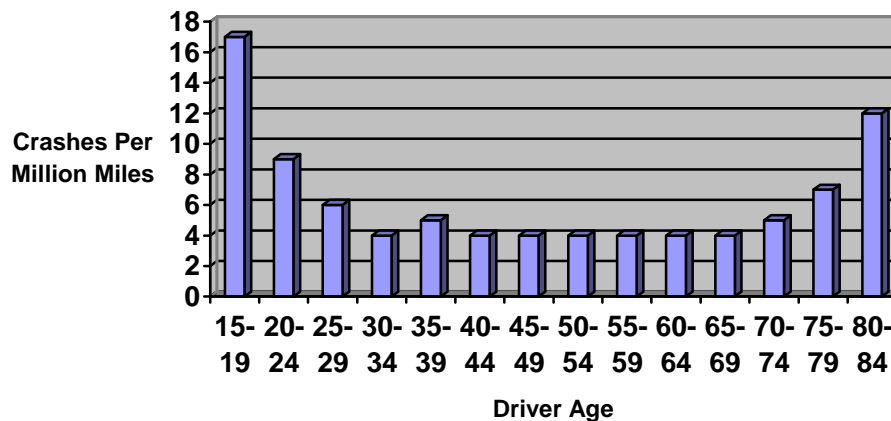


Figure 1. Accident Rate by Driver's Age.

Driver education in European countries is much more rigorous than that in the United States. Classroom training is presented on vehicle operating principles and basic maintenance. Typically, behind-the-wheel training provides much more emphasis on the more advanced aspects of vehicle handling in potentially hazardous conditions. Also, the minimum age for driver licensing is usually higher than the ages mandated by the States in the U.S.

Several organizations in the United States offer training in advanced vehicle handling for novice drivers (Burris, 2005; Car Control, n.d. a). Such training typically includes vehicle control on skid pads, obstacle avoidance, rapid deceleration braking, and maneuvering near the vehicle performance limits. While there is considerable anecdotal evidence that such training added to

the standard driver instruction, creates a more skilled and capable novice driver (Car Control, n.d. b), few systematic studies of its effect on the safety of young drivers have been completed. Where such studies have been done, results are contradictory and subject to interpretation and controversy (Jones, 1995).

3.2. Research on Driver Training

A large percentage of young drivers receive their driving training in school-based classes. These classes require numerous hours (typically 30) of classroom instruction on rules of the road, vehicle operation, and safety. The nascent drivers then spend several hours (typically 6) behind the steering wheel driving in parking lots or in normal traffic on familiar streets. Only rarely do they experience circumstances in which the vehicle must be handled at its performance limits. Most carefully controlled research has found that standard driver education classes have little impact on subsequent driving safety (Mayhew and Simpson, 2002).

Many questions have been raised concerning the effectiveness of conventional young driver's education programs. Some advocates declare young driver's education programs as being successful, while other experts declare failure of such programs. Allan F. Williams (2003), former researcher at the Insurance Institute for Highway Safety, declared these short-term programs as an unrealistic means to increasing the safety of young drivers. On the contrary, a recent study conducted by the Oregon Department of Transportation (ODOT) and the Center for Applied Research found "significantly lower rates of convictions, suspensions and crashes" for those taking the driver education course versus those who learned through 50 hours of informal, supervised training (Triplett, 2005).

International literature demonstrates little proof that formal driver instruction increases driver safety, yet arguably these programs have failed to adequately address age and experience related factors that contribute to young driver's increased risk of accidents. It is believed that such programs can be more effective if they are more empirically based, addressing the age and experience related factors (Mayhew and Simpson, 2002). Mayhew and Simpson state the reasons why formal instruction fails to reduce crashes:

- Driver education/training fails to teach the knowledge and skills critical for safe driving,
- Driver education does teach safety skills but students are not motivated to use them,
- Driver education fosters overconfidence,
- Driver education fails to adequately address lifestyle issues,
- Driver education fails to tailor content to student needs.

The well-known Dekalb driver education study, conducted in suburban Atlanta, was one of the first attempts to systematically validate the benefits of driver education (Stock, et al., 1983). A cohort of 16,000 high school students was examined. The participants were divided into three groups receiving no training at all, a minimal curriculum of 20 hours of training, or a Safe Performance Curriculum (SPC) of 70 hours of training. The SPC curriculum was based on a task analysis of required driver skills but little information survives about how it was conducted. The Dekalb study methodology has generated considerable subsequent debate, especially

concerning the equivalency of the three groups. The most important conclusion was that there was no statistically significant long-term difference between the training groups in driving safety. One observation was that drivers in the "no training" group delayed obtaining their driver's licenses as compared to drivers in the other groups.

Mayhew and Simpson (2002) completed a synthesis of research related to safety benefits of young driver training. They concluded that the major effect of traditional, school-affiliated driver education programs is to make licensing more readily available to younger drivers. They found no clear evidence that these traditional programs have a positive impact on safe driving. The authors recommended a multistage training approach in which the traditional training is later supplemented by a carefully designed advanced training program that:

- Is focused on psychomotor, cognitive, and perceptual skills shown to be associated with high collision rates among young drivers,
- Includes experiences demonstrating the value of safe driving practices,
- Incorporates experiences that make the drivers more aware of their own limitations,
- Uses techniques developed to address lifestyle and risk-taking behaviors,
- Recognizes that there are individual differences in skill levels and addresses specific skill deficiencies of the individual participants.

Such an approach is advocated by the American Driver and Traffic Safety Education Association as part of a graduated licensing system in which, "Initial training of novice drivers will provide basic vehicle handling skills and the second training course will provide other safe driving skills, including enhanced decision making to reduce the risk of young drivers (Robinson, 2001)."

A study of over 400 graduates of an urban, east coast course for young, previously licensed drivers reported that the graduates had 77% fewer accidents than their peers (Car Control, n.d. b). That number, however, was probably inflated by a weak research design in which the more careful and highly motivated teens were self-selected into the training classes. A much more carefully designed and controlled study was needed to validate those striking results.

Skill-based training has created much discussion among driver education experts. Research has shown that skill based strategies produce overconfidence of one's own skills (Gregersen 1996a). For example, Glad (1988) found that those partaking in skid training, as mandatory part of the training experienced an increase in slippery road accidents. Another study found that after the introduction of skid training into the education curriculum higher rates of accidents occurred in slippery road conditions (Keskinene et al., 1992). It is believed that skid training courses were based mostly on maneuvering skills, leading to overconfidence. To counter this effect it has been suggested that a distinction be made between training of skills and training of risk-awareness. Skill-based training concerns understanding vehicle control and maneuvering while risk-awareness is designed to increase knowledge, experience and recognition of dangers (Gregersen, 1996b; Advanced, 2003). A recent study on the effectiveness of skid-car training for teenage novice drivers in Oregon found that females who received skid-car training had no effect on crash rates, while the males appeared to have higher rates in the two years after training. However it did appear that those receiving the training had relatively fewer slick-surface and rear-end collisions (Jones, 1995).

The EU project Advanced (2003) developed several recommendations for post license driver training. These recommendations were not objectively based, rather on the general agreement of the researchers and investigators working in the area. The general recommendations include:

- Courses should focus on the specific needs of the participant and encourage them to improve their driving style and behavior,
- Track based driver courses should focus more on risk awareness than on maneuvering skills,
- Comprehensive feedback and discussion sessions should be conducted after each on-road exercise,
- To maintain individual attention group size should not exceed 10 participants per instructor during track-based courses,
- Training must be relevant to real-life situations, exercises and discussion should be related to real life scenarios,
- Overconfidence should be avoided, this is done by allowing students to fail (i.e. hit obstacles, lose full or temporary control of the vehicle),
- Good client-trainer relations appears to have the greatest influence on the participant throughout the course.

Graduated licensing programs have been shown to significantly reduce young driver accidents and fatalities. While these programs don't necessarily improve the skills of young drivers, they do reduce their miles of driving and their exposure to peer pressure and hazardous driving conditions during their early driving years. During the 2005 legislative session, a form of graduated licensing was instituted for Montana. It is too early to determine whether the expected benefits will materialize.

4. METHODOLOGY

The overall project is divided into three phases. Phase 1 includes development of training plans and materials and recruiting and scheduling young driver participants. Phase 2 included the actual presentation of the training workshops. Phase 3 will include a longitudinal study of the driving histories of the young participants. This report covers Phase 1 of the overall project.

The Phase 1 effort required the following tasks:

- Identification of potential teenaged driver participants,
- Development of recruiting materials,
- Recruitment and scheduling of participants,
- Preparation of training plans and instructional materials,
- Coordination with the Montana Office of Public Instruction.

4.1. Identification of Potential Participants

Potential participants were identified through coordination with high school administrators of school districts in Central Montana that provide driver education classes. Meetings were scheduled and briefings presented to administrators from Great Falls, Billings, and Lewistown. In addition, project staff made presentations to a meeting of the Central Montana Superintendents Association and to the Montana Traffic Education Conference to request participation of school districts in the program.

To ensure the inclusion of Native American students in the sample, telephone contacts were made with administrators at Harlem High School which was outside the original study area but within a two-hour drive from Lewistown. No other high school with a high Native American population was closer than a three-hour drive from Lewistown.

Administrators who agreed to take part were asked to provide contact information for the parents of students who graduated from their high school driver education programs during summer or winter 2004. This provided mailing addresses to reach teen drivers who had graduated from the driver education programs during a period of 6 – 12 months before the advanced workshops would be conducted.

Contact information was obtained for approximately 1520 students in the form of mailing labels or addresses.

4.2. Development of Recruiting Materials

A package of materials was developed for mailing to parents of potential participants. The package included a cover letter to parents summarizing the program and inviting them to apply for their teen, a full-color brochure describing the program in more detail and including color photographs of the training facility and process, and a mail-in card to complete and register their teens. A copy of the recruiting brochure is contained in Appendix 1.

4.3. Recruiting and Scheduling of Participants

Invitations to participate and information brochures were mailed by first class mail to 1400 families using the mailing addresses supplied by the school districts. The mailings were sent in three groups of 500, 500, and 400 information packages. A small number, (fewer than 10) participants, were from school districts which had not supplied mailing addresses but who were otherwise eligible and contacted us asking to be enrolled in the research.

Training was scheduled on 18 days during June, July, and August 2005. To simplify the logistics of transporting participants from their home towns to Lewistown, days were designated for Billings students, Great Falls students, Harlem students, or Other students. Transportation was contracted with the school district's transportation providers for Billings, Great Falls, and Harlem. Students from other central Montana schools were closer to Lewistown and provided their own transport.

Participants were telephoned at their home numbers and scheduled to participate on one of the dates set aside for their school districts. They were also called the day before their scheduled participation as a reminder and to assure that they were still available. On days that there were insufficient numbers available from the scheduled town, available slots were offered to participants from the local Lewistown area or other nearby districts.

4.4. Preparation of Training Plans and Instructional Materials

The initial step in development of the training curriculum was to determine the safety challenges faced by Montana's young drivers. A detailed summary of accident reports for teen-aged drivers was obtained from the Motor Vehicle Division of the Montana Department of Justice and tabulated by accident conditions and primary accident causes.

Using these data, we developed a list of Knowledge, Skills, and Attitudes to be taught in the workshops. These were adapted from Mottola's "10 Habits" for safe driving (Mottola, 1996) and included the following high level elements:

- Show driver and vehicle readiness,
- Keep car in balance,
- Accurately position vehicle,
- Establish clear path,
- Handle Line-of-Sight/Path-of-Travel (LOS/POT) blockages,
- Control intersections,
- Control rear zones,
- Control curves,
- Control vehicles in front,
- Control emergency situations.

Training methods including interactive and multimedia classroom instruction, demonstrations, and in-vehicle exercises were designed to provide detailed experience on these instructional elements. An 8-hour training schedule in which the teen-aged participants rotated between

training stations was developed. Finally, Mottola provided training to the designated Office of Public Instruction driver educators in the use of the training curriculum.

4.5. Coordination of Training with Office of Public Instruction

The use of facilities and driver educators from the Montana DRIVE facility in Lewistown was critical to the success of this effort. Mr. Dave Huff, Director of Traffic Education Programs at OPI served as the liaison with the DRIVE facility and with high school driver educators in Central Montana. Issues of training logistics, facility scheduling, coordination between the instructional program developer and the instructional staff, resource needs, and a host of other issues were handled during frequent meetings and teleconferences between WTI and OPI.

5. RESULTS AND PRODUCTS

5.1. Participant Recruitment

Invitations to participate and information brochures were mailed by first class mail to 1400 families using the mailing addresses supplied by the school districts. Approximately 40 of the mailings were returned as undeliverable. The mailings were sent in three groups of 500, 500, and 400 information packages. A small number, (fewer than 10) participants, were from school districts which had not supplied mailing addresses but were otherwise eligible and contacted us asking to be enrolled in the research.

The primary high schools within the recruiting area average approximately 6% Native American students. This compares to the statewide average of 10%. To ensure the inclusion of a representative sample of Native American students in the sample, contacts were made with administrators at Harlem High School and students recruited from their driver education classes. Harlem High School has over 98% Native American students. Harlem is outside the original study area but within a two-hour drive from Lewistown. No other high school with a large Native American population was closer than a three-hour drive from Lewistown. Native-American students totaled 29 for an average of 8.4%.

Registration cards were completed and returned by approximately 365 families. The returns consisted of 52% male participants and 48% female participants. The participants' response cards were randomly divided into two equal groups, the training group and the control group, maintaining the 52/48 gender ratio. After the cards were received and initially assigned to groups, approximately 20 participants withdrew for various reasons (moved from the state, unavailable for the entire summer, chose not to participate, or our inability to contact them using the provided contact information).

5.2. Training Workshop Plan and Materials

5.2.1. Analysis of Montana Young Driver Accident Data.

Montana traffic accident data of accidents involving 15 and 16 year old drivers during the years 2001 – 2003 were examined to identify and document challenges faced by young Montana drivers. The information was incorporated at appropriate places in the workshop training materials. It was also used to customize the workshop curriculum content for Montana drivers and challenges. Some of the findings of the analysis included the following:

- There were 19 fatalities of 15-16 year olds from single-vehicle crashes and 15 fatalities from crashes with two or more vehicles,
- There were 272 incapacitating injuries from 6216 total crashes involving 15-16 year olds,
- The two months of July and August accounted for 53% of the fatalities, but only 17% of the total crashes,
- Wet, ice and loose gravel road conditions accounted for 42% of the single-car fatalities,
- Fifty-three percent of the single-vehicle fatalities occurred on County Roads,

- Sixty percent of multiple-vehicle fatalities occurred on State Highways,
- Sixty-seven percent of the single-vehicle fatalities occurred at curves and/or grades (although not listed, it is suspected that the grades were downgrades),
- Twenty-two percent of all non-fatal crashes occurred at curves and/or grades,
- In 58% of the single-vehicle fatalities “Speed too fast” was cited as a driver contributing circumstance. Inattentive driving was cited in 32% of the single-vehicle fatalities,
- “Speed too fast” and/or “Inattentive driving” was a contributing circumstance in 82% of all 15-16 year old fatalities,
- The major environmental contributing factor was a curve in the roadway,
- The major road surface contributing factor was contributed by icy/slushy conditions,
- Pickup trucks and SUVs represented 47% of the vehicle body style that resulted in single vehicle fatalities,
- Pickup trucks and SUVs represented 62% of the vehicle body style in all crashes,
- Vehicle overturns was the first harmful event for 74% of the single-vehicle fatalities,
- Vehicle overturns was the first harmful event for 38% of the single-vehicle non-fatalities,
- Males are slightly more represented in all crashes than females,
- Fifteen year olds were involved in 68% of single-vehicle fatalities,
- Sixteen year olds were involved in 59% of non-fatal single-vehicle crashes,
- Sixteen year olds were involved in 60% of fatal multi-vehicle crashes,
- Sixteen year olds were involved in 63% of non-fatal multi-vehicle crashes,
- The driver was not licensed in 42% of single-vehicle fatalities,
- The driver was licensed in 78% of multi-vehicle fatalities,
- The driver/occupant did not use safety belts in 87% of the single-vehicle fatalities,
- The driver/occupant did not use safety belts in 59% of the multi-vehicle fatalities,
- The driver/occupant used lap and shoulder belts in 64% of the non-fatal crashes,
- An air bag was deployed in 11% of all crashes,

- The driver/occupant was ejected or partially ejected in 61% of the single-vehicle fatalities,
- The driver/occupant was not ejected in 97% of the non-fatal crashes,
- Incapacitating injuries occurred in 14% of all crashes,
- The driver was killed in 43% of the single-vehicle fatalities,
- The passenger was killed in 57% of the single-vehicle fatalities,
- The driver was killed in 78% of the multi-vehicle fatalities.

5.2.2. Training Schedule

Ten distinct activities were scheduled during the 8-hour training workshop. The activities were based on Mottola's "10 Habits" of a safe driver (Mottola, 1996) with slight modifications to recognize the unique challenges faced by Montana young drivers. Each day, 12 students were scheduled to take part in the workshops. A detailed training schedule was developed for rotating the 12 students among the 10 activities while still maintaining the building-block training approach in which completion of some activities was a prerequisite for starting another activity.

5.2.3. Pre-Training E-Books

Two e-book periods were scheduled, one in the morning and one in the afternoon. The morning e-book period consisted of a 15-minute interactive multimedia presentation covering the following:

- Risk factors in driving and how to evaluate and control them,
- Use of safety belts,
- Use of visual targets to guide steering movements and skid recovery.

An additional pretest presented the participants with photographs of 16 traffic situations and asked them to evaluate potential driving scenarios and the risks they presented.

The afternoon e-book period consisted of an interactive multimedia presentation covering the following:

- Using visual reference points within the vehicle to identify lane position,
- Decision making for off-road recoveries,
- Using transition pegs to determine when to turn and brake.

It also included two brief video clips. The video clips covered visual search patterns on rural highways with curves and grades that limit the line-of-sight and they covered techniques for maintaining a safe path during urban driving.

5.2.4. Classroom PowerPoint Presentations

Two PowerPoint presentations were developed for presentation to the participants. The first presentation, designed to be presented at the beginning of the workshop covered the following:

- Causes of accidents among young Montana drivers,
- The forces that operate on a vehicle while driving,
- The consequences of allowing those forces to get out of balance.

The second presentation covered the following:

- The use of vision to keep the car in balance,
- Selection of visual targets and recognizing the path-of-travel,
- The use of reference points and transition pegs to identify the car's location and the appropriate time and place to begin maneuvers,
- Four second danger zone,
- Visual search in curves,
- Evasive maneuvers.

5.2.5. In-Vehicle Exercises

In-vehicle activities were designed to meet the instructional objectives represented by the "Ten Habits" concept. The in-vehicle activities used a small sedan, a larger sedan, and an SUV. These vehicles could be operated either normally or with activation of the Skid Monster attachment.

These activities included the following:

- Getting ready to drive. These elements included correctly positioning the seat and mirrors. Correct sitting position. Correct hand positions and foot positions. Attachment of safety belts,
- Vision and motion control. These elements included the use of central and peripheral vision to check identify the target (point toward which the car is driving), check the zones around the vehicle, maintain the path-of-travel (POT) to the target. It included the use of reference points within the vehicle to help recognize the position of the vehicle on the roadway,
- Steering techniques. These elements included use of the hand-over-hand or push-pull method of steering to smoothly steer the vehicle along the selected POT and the use of turn signals. It included searching the target area when approaching curves. It included the use of transition pegs as visual cues for steering, braking, and acceleration actions,
- Intersection behaviors. These elements included identifying the vehicle's location in an intersection using reference points, LOS/POT blockages, turns from a stop and turns while moving including clearing left/front/right zones, use of targets, skid detection and recovery,

- Acceleration techniques. These elements include checking zones for an open path and accelerating smoothly toward the target,
- Braking techniques. These elements include controlling the rear zone for traffic, using the visual target, and braking smoothly while keeping the vehicle in balance,
- Use of reference points and transition pegs. These elements included using points in the vehicle and in the environment as visual cues for the position of the vehicle in the roadway or intersection and to signal when to take specific control actions,
- Off-road recovery. These elements included recognition of a departure from the road and techniques for a safe recovery from a level or sloping roadside environment,
- Skid Monster control. These elements included techniques for driving a vehicle with a reduced coefficient of friction with the road (e.g., wet, icy or gravel). Target selection and use, steering techniques, accelerating and braking,
- Skid management. These elements included skid detection using targets, detecting and correcting yaw, acceleration and braking techniques, decreasing radius turns, simulated late exits,
- Emergency responses. These elements included recovery from tire blowouts and techniques for evasive maneuvers including focusing the vision on the target and POT, deciding whether to use an evasive braking or steering response, selecting a new target, keeping the vehicle in balance, and steering or braking toward the target area.

6. CONCLUSIONS

The first objective of this phase of the project was to recruit a representative sample of approximately 400 teen high school driver education graduates from classes in central Montana schools. These participants were restricted to teens who had graduated from driver education between June 2004 and January 2005. This provided them with six to twelve months of driving experience before a series of scheduled advanced defensive driving workshops at the Montana DRIVE facility in Lewistown in the summer of 2005.

School districts in central Montana were solicited to participate by supplying us with contact information for their recent driver education program graduates. Administrators agreeing to participate provided mailing labels or addresses for the parents of the candidate students. A sample of 1400 Montana teens meeting the above criteria were invited to participate in the research using information packets sent by first class mail to their parents. Approximately 26% of these students volunteered to take part.

The second objective was to develop plans, curriculum, and materials for a one-day advanced defensive driving workshop that would be presented by the Montana Office of Public Instruction at the Montana DRIVE facility. A detailed curriculum including reading material, multimedia presentations, demonstrations, and in-vehicle exercises was developed. During Phase 2 of this effort, the developed curriculum was presented during one-day workshops to half of the volunteers.

The third objective was to coordinate logistics for presentation of the workshops at the Montana DRIVE facility. OPI scheduled 18 days during summer 2005 that were reserved for the teen driver training at the DRIVE facility. A cadre of experienced driver educators was selected and trained by the instructional developer to provide the advanced defensive driving training to the teens.

While no data are yet available concerning safety benefits of the workshops, OPI and the DRIVE instructors reported that they are pleased at the progress demonstrated by the participants. OPI will procure training equipment similar to the Skid Monster attachments used in the workshops. The curriculum developed for these workshops will be revised to account for any lessons-learned and will be continued as a regular workshop offering at the Montana DRIVE facility during summer 2006 and beyond.

A report on the conduct of the training workshops and surveys of participants in the study (Phase 2) is in preparation.

7. RECOMMENDATIONS

The project was initially conceived as a three-phase effort. Phase 2, presentation of the planned training was conducted during the summer of 2005. Phase 3 is planned to consist of a four-year follow-up with participants who received the advanced defensive driving training as well as with a control group of subjects who did not receive the training.

Phase 2 of the effort recruited slightly fewer of the subjects than planned (approximately 88 percent). While the estimated response of 25% initial positive returns was accurate, the number of participants who moved or who responded positively but were then unable to participate was higher than expected. WTI's analysis approach loses a small amount of discriminability with the change from 200 participants to 175 participants in each group but the analysis is still meaningful. WTI recommends that the planned Phase 3 effort be completed as scheduled.

During the 2005 legislative session, a form of graduated licensing for teen drivers was instituted by the Montana legislature. Typically, states with graduated licensure experience a reduction in teen accidents and fatalities. It is not clear whether these reductions can be attributed to more careful driving or simply to fewer miles being driven by the young drivers. At any rate, there are recommendations that a secondary training program be included in the graduated licensing requirements before full driving privileges are conferred. A future study may investigate whether a workshop such as this could meet that secondary training requirement.

The training provided in this project was presented at the Montana DRIVE facility in Lewistown. This facility is a lengthy trip from many places in Montana. OPI should investigate whether an advanced defensive driving workshop for teens could be presented in other locations throughout the state such as large church or school parking lots. This would make the training readily available to a larger number of participants.

The training workshop was well received by participants and parents. Numerous parents of participants contacted WTI requesting information about how their younger students might take this workshop in the future. It is our understanding that OPI and Montana State University-Northern are purchasing SkidMonster equipment like that used in these workshops. We would recommend that teen workshops be made available at the Montana DRIVE facility during the summer of 2006 and beyond at the expense of future young drivers. Such workshops could be based on the training curriculum developed here with revisions according to any lessons-learned during the presentations.

8. REFERENCES

ADVANCED. The EU ADVANCED project: Description and analysis of post-license driver and rider training. Final Report, September 30, 2003.

Burris, P. Partners for Highway Safety. Retrieved July 22, 2004 from <http://trafficsafety.net> (n.d.).

Car Control. About The Clinic. Retrieved April 14, 2004 from <http://www.carcontrol.com/handson.htm> (n.d.). b.

Car Control. Department of Highway Safety Reports Car Control Clinic Reduces Teen Crash Rate By 77%. Retrieved April 14, 2004 from <http://www.carcontrol.com/FL-DHSMV.htm> (n.d.). a.

Glad, A. Fase 2 I foreopplaringen. Effekt pa ulykkes risikoen. Rapport 0015, Transportøkonomisk institutt, Oslo. 1988.

Gregersen, N.P. Young car drivers. Why they are overrepresented in traffic accidents? How can driver training improve their situation? VTI report 409A. Swedish National Road and Transport Research Institute. 1996a.

Gregersen, N.P. Young drivers' overestimation of their own skill – an experiment in the relation between training strategy and skill. *Accident Analysis & Prevention*, 28(2), 243-250, 1996b.

Jones, B., The effectiveness of Skid-car Training for Teenage Novice Drivers in Oregon. Oregon Department of Transportation. The Chronicle Winter Issue (1995).

Keskinene, E., Hatakka, M., Katila, A. & Laapotti, S. Was the renewal of the driver training successful? The final report of the follow-up group (in Finnish). Psychological reports no. 94, University of Turku. 1992.

Mayhew, D. R. & Simpson, H. M., "The safety value of driver education and training." *Injury Prevention*, Vol. 8, (2002) pp. ii3-ii8.

Mottola, F. "The Zone Control System Provides Blueprint For Risk Reduction Habits." The ADTSEA Chronicle, Vol. 44, (Fall 1996).

Robinson, A. R., "Objectives of advanced driver education." *The ADTSEA Chronicle*, Vol. 49, (2001) pp. 1-3.

Stock, J. R., Weaver, J. K., Ray, H.W., Brink, J.R., & Sadof, M. G., "Evaluation of Safe Performance Secondary School Driver Education Curriculum Demonstration Project-Final Report, DOT HS-806 568. National Highway Traffic Safety Administration, Washington, DC (June 1983).

Triplett, W. "Teen Driving." *The CQ Researcher* 15:1. (2005) pp. 6-7.

U. S. Department of Transportation, Bureau of Transportation Statistics, "National Transportation Statistics (NTS) 2004" Washington, DC: U.S. Government Printing Office, 2005, 600 pp..

Williams, A.F. "Teenage Drivers: Patterns of Risk." *Journal of Safety Research* (34). (2003). pp. 5-15.

9. APPENDIX 1

INVITATION TO PARTICIPATE ADVANCED DEFENSIVE DRIVING WORKSHOP FOR NEW TEEN-AGED DRIVERS

As a recent graduate of your high school's driver education program, your student is invited to take part in an exciting new research program that is being sponsored by the Montana Department of Transportation. MDT is working with Montana State University and the Montana Office of Public Instruction to find ways to improve the safety of Montana's young drivers.



Montana State University is looking for 400 teen-aged drivers from central Montana to take part in this research project.

Half of these 400 young drivers will be selected by random drawing to take part in a one-day advanced defensive driving workshop. The workshop will be **FREE OF CHARGE** to the participants. It will be taught by the expert training staff of the Montana DRIVE advanced driving facility in Lewistown. It will use a curriculum and teaching methods especially designed for young Montana drivers by renowned driving safety expert Professor Fred Mottola. The training will be in both a classroom and in specially equipped training vehicles and will emphasize effective methods of accident avoidance.

What about the 200 young drivers who volunteer to take part in the research study whose names are not drawn to attend the training workshop in Lewistown? If your young driver's name is not drawn to take the advanced driving workshop, we still want them to take part in the research project.

We will keep track of the driving experiences of all 400 of the young drivers in our study for a period of four years. At the start of the project we will ask all of the students to tell us about their driving experiences during the first months they had their driver's licenses. Then, once a year for the four years, we will write to them asking for an update. We will ask them to complete a brief questionnaire and we'll send them a payment of \$10 when they return the questionnaire.

Why are we doing this?

Young teen-aged drivers have by far the highest risk of serious accidents of any age group. In fact, sixteen year old drivers have a fatal accident rate that is eight times that of drivers in their twenties and thirties. While high school driver education programs can provide a basic foundation of skills, more is needed to make a safe young driver. We want to find out whether adding one day of more advanced training can make the young drivers safer.



What happens during the workshop?

The workshops will be conducted during the summer of 2005. Students whose names are drawn for the workshop will receive a small amount of study materials about two weeks before their scheduled session. They should go over these materials to prepare for the workshop.

They will arrive at the Montana DRIVE facility near the Lewistown airport at 8:00 AM with a class of about 12 students. There will be one experienced instructor for each two students. The workshop will last the full day.

The workshop will have a combination of classroom and in-vehicle activities. The activities will be designed to help the young drivers avoid the most common types of accidents that new Montana drivers encounter. These include:

- Loss of control on icy or gravel roads,
- Recovery if wheels leave the pavement,
- Avoiding obstacles in the roadway,
- Being aware of the traffic situations and recognizing potential hazards,
- Avoiding risks and peer pressures.

At the end of the day, each young driver will be given a personalized assessment of their skills and suggestions for additional exercises to work on with their parents.



For many of the exercises, the training cars will be equipped with a special device, the SkidMonster™, that attaches to the wheels to simulate driving on icy or slippery roads. This allows the young drivers to experience loss of control and to practice skid recovery at very safe speeds of only 10 – 15 miles per hour.

How much will this cost my student?

Attendance at the workshop is being fully paid by the Montana Department of Transportation and MSU. **There will be no cost to your student.** For students from outside the Lewistown area, we will even provide free bus transportation from their high schools to the Lewistown DRIVE facility.



Can parents observe the workshop?

Parents of the students taking the workshop are welcome to observe the training. However, we will have no special activities for the parents and will ask that they not interact with their students during the training as this could distract the students. Adults who are interested in attending a similar workshop at DRIVE can learn more by visiting:

www.opi.state.mt.us/DRIVE

How can my student volunteer?

Your student can volunteer to take part in the driver training research project by completing the enclosed postcard and returning it to us. We will then contact volunteers with more information and to schedule their participation. If you have questions about this research or about how your student can become involved, contact the Project Director:

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